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THE RECLAMATION BOARD

DEPARTMENT OF HEALTH SERVICES

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APPEARANCES

BOARD MEMBERS

Mr. Benjamin Carter, President

Mr. Butch Hodgkins, Vice President

Ms. Lady Bug Doherty, Secretary

Ms. Rose Marie Burroughs, Member

STAFF

Mr. Jay Punia, General Manager

Mr. Stephen Bradley, Chief Engineer

Mr. Dan Fua, Supervising Engineer

Mr. Scott Morgan, Legal Counsel

Ms. Lorraine Pendlebury, Staff Assistant

DEPARTMENT OF WATER RESOURCES

Mr. Steve Cowdin, Economist

Mr. Les Harder, Deputy Director

Mr. Rod Mayer, Chief, Division of Flood Management

ALSO PRESENT

Mr. Stein Buer, Sacramento Area Flood Control Association

Mr. Joe Countryman, MBK Engineers

Mr. Tom Eres

APPEARANCES CONTINUED

ALSO PRESENT

Mr. Gary Estes

Dr. David Ford, David Ford Consulting Engineers

Mr. Scott Shapiro, California Central Valley Flood Control Association

Mr. Ronald Stork, Friends of the River

Mr. Jeff Twitchell, Wood Rogers

Mr. Tim Washburn, Sacramento Area Flood Control Association

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PROCEEDINGS

PRESIDENT CARTER: Good afternoon, ladies and gentlemen. My name is Ben Carter. I'm President of the Board of the State Reclamation Board. I'd like to welcome you all here this afternoon. This is a lovely auditorium. And we are here as apart of a Reclamation Board workshop. The purpose of which we'll get into in just a second. But what I'd like to do is ask General Manager Punia to call the roll.

GENERAL MANAGER PUNIA: Jay Punia, General Manager Reclamation Board. For the record, except Board Member Teri Rie, the rest of the members are present.

PRESIDENT CARTER: Okay. Thank you. As a couple of housekeeping items, copies of today's agenda are at the entrance over here to your right my left. Also, there's a stack of little 3 by 5 cards. These cards are for any of you to submit to Ms. Lorraine Pendlebury here in the front. And those cards are to help us be sure that anybody who wants to speak gets a chance to speak as part of this process. So please fill those out.

I think during the presentation of the report, we'd like to keep this somewhat interactive. If you have questions of clarification with regard to details on the report, please feel free to raise your hand and ask those during the presentation. If you have more technical

questions or perhaps some more discussion-type questions, then please try and hold those until the conclusion of the presentation. There is quite a bit of material to go through. What we'll do is we'll have the presentation, then we'll have a short break and then we'll continue the workshop today discussing the content of the presentation.

So with that, then obviously the purpose of today is to hear public comments on a draft report on the options for measuring and preventing and mitigating impacts due to improvements to the Sacramento and San Joaquin Flood Control Projects. It is the desire and goal of the State Reclamation Board and DWR and I believe the citizens of this State to improve our public safety and flood control system.

This Board felt that we needed to have some context and some, both technical as well as procedural, advice on the implications of some of those improvements. And that is the reason that the Board asked a group of -- the State Reclamation Board, DWR and flood control experts to convene, spearheaded by Mr. David Ford, to basically outline some of the options and a framework by which the Board can establish some context for some of the policy decisions that it will face -- it does face and will face in the near future.

So that's why we're here. We absolutely want

your feedback, your thoughts on this. It is a draft report. There is no action to be taken today. I repeat, the Board will not take any action today on this report. This is purely kind of an advisory effort and a chance and an opportunity for everyone to kind of exchange thoughts and ideas about this particular topic and the content herein.

So with that, I'm going to turn it over to Dr. Ford and he's going to give us a synopsis of the report. Just in case you all didn't get a copy, it is available on our website, the address which is on the agenda today. So in case you haven't gotten that, I don't think we have copies here, but it is available on the web site and we'll be going through the primary content of it now.

So with that, thank you.

I stand corrected, our chief attorney and legal counsel Scott Morgan, did you want to make a couple comments about today's process?

STAFF COUNSEL MORGAN: Do you want me to?

GENERAL MANAGER PUNIA: Yes.

PRESIDENT CARTER: He wants to make some comments.

STAFF COUNSEL MORGAN: Well, I do what the Board wants.

Just to reiterate what President Carter said,

this is an informational briefing. And it really, although it's a workshop and there can be exchange of ideas, is a process of information coming from whatever Dr. Ford is presenting and whatever the public wants to present to the Board for their information. Don't expect the Board to make any decisions. Don't expect the Board to reach any conclusions or say now, that's the way we should be doing it. That's not on the agenda. That's really not something the Board can do anyway outside of the scope of regulations.

So this is an informational document prepared for the Board and paid for by the Department of Water Resources to provide some background information on this very significant issue that will be confronting the Board as a lot of projects go forward that potentially have hydraulic impacts. And it gives the Board, as President Carter said, someway of evaluating it. But it's very limited in scope. This is just information. And anyone who has some additional formation that would like to provide it, obviously, they're welcome to provide it. That's it.

I know at least one board member, who's gazing at me now, is interested in the fact that the legal issues sort of underlie a lot of this, and we're a trigger for a lot of this. There's no discussion of the legal issues on

the agenda today. I won't be talking about that, but I'll be glad to take questions, write them down and get back to the Board members at a later time. That's my dodge of the legal issue.

GENERAL MANAGER PUNIA: Good afternoon then. Jay Punia, General Manager of the Reclamation Board. Board President Ben Carter and board members and fellow flood control officials, thank you for spending this afternoon with us, rather than enjoying the outside, sitting with us and discussing this topic. I think, as all of you know, this is a very important topic, so I'm glad that you have set aside this time to spend with us.

The topic in front, as President Ben Carter mentioned, is to measure and mitigate impacts due to the improvements to the Sacramento and San Joaquin Flood Control Projects. In my judgment, this is the single most important item in front of all of us to implement Proposition 1E and 84. The day I took this job as the General Manager, I knew that we had to address this issue and that's why we are here and we'll continue to work on this subject until we have a good handle on this.

The hydraulic analysis of new projects has always been very important. But presently it's even more important and I will touch on this a little later. In the flood business, as all of us know, the paradigm is

shifting as we speak. And it's shifting and changing very fast. And this change has made it necessary that we address this issue soon, so that the new projects can be implemented.

As you already know or you will realize after Dr. David Ford's presentation, this subject is very complex. With the new funding from the proposition, the project is going to change. And we have to bring this change in such a fashion that it is fair to all project users and that it's done right and it should be an efficient process. We cannot wait forever to implement new projects.

And on a personal note, previous generations have built the Sacramento River Flood Control Project, San Joaquin River Flood Control Project, Central Valley Project, State Water Project. We are all enjoying the benefits of these great projects. And my generation, the Baby-Boomers so far has mainly written feasibility studies and the Environmental Impact Reports.

Now with the proposition fundings in place, we have a chance to make a difference. We do not want to leave a legacy that we were given the funding and we screwed up a nice functioning flood control project. Although, we usually use 50 years project life cycle for economic analysis, but such projects are here to stay for a long time, and it's our responsibility to maintain them

and modify them wisely so that the future generations can continue to enjoy their benefits.

(Thereupon an overhead presentation was Presented as follows.)

GENERAL MANAGER PUNIA: Let's talk about the new paradigm. I think all of us are familiar with the traditional approach. Examples are the American River Common Features Project, various phases of the Levee Reconstruction Project. As you all know, under this process, the Corps is the lead and the Reclamation Board and the State is usually the non-federal sponsor, and we have the local sponsors either city or county, Sacramento Area Flood Control Agency.

The Corps pays the major portion of the funding under this scenario, our traditional approach. And I'm sure most of the people here have seen the U.S. Army Corps of Engineers' brochure, Six Steps To A Civil Works. There are only 6 steps, but sometimes it takes maybe 15 years to implement. There is good and bad in this long duration. Under this traditional approach, it takes a long time to implement projects and the Corps has the time and they analyze all these hydraulic impacts before modifying the projects. We may not have that type of time and I'm glad that we won't spend that much time to implement new projects.

The second scenario which is emerging is where the State and the locals will take the lead and try to implement new projects with support from the US Army Corps of Engineers. And the examples of those projects, the Natomas Basin Project and the Three Rivers Levee Improvement Authority Project may fall into that category. And then there's a third category --

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GENERAL MANAGER PUNIA: -- which is a private sector or developer-funded project modifications. And the examples are River Islands Project near Lathrop that we're -- the State is not directly involved in the development of that project. We are issuing an encroachment permit. So those are outside the conventional partnerships between the U.S. Army Corps of Engineers, State and the local agencies that these are the projects coming through the development -- medium where they want to develop the land and try to implement modifications to the projects.

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GENERAL MANAGER PUNIA: And quickly so that we all understand the role that the Reclamation Board plays in all these projects. The traditional approach, in which the Corps leads the major flood control projects, the Rec Board is the non-federal sponsor for these projects and

cost shares the project with the U.S. Army Corps of Engineers. And once the projects are built, the U.S. Army Corps of Engineers hands over the project back to the State through the Reclamation Board. And we ensure the U.S. Army Corps of Engineers that the project will be maintained according to the operation and maintenance standards. And then we also provide then the land easement and right of way for constructing these projects.

Under the second category, which is a State and local agency leads major flood control projects with Corps support, The Rec Board will issue an encroachment permit, so we are not the non-federal sponsor in the case, but The Rec Board is issuing an encroachment permit before the permit -- before that project can be implemented. And we will also request and coordinate approval from the U.S. Army Corps of Engineers for project modifications under Section 208 or Section 408. That's a major action from the U.S. Army Corps of Engineers, which we will be working with the local agencies and the State of California, Department of Water Resources to get the U.S. Army Corps of Engineers' authorization, so that the federal flood control project can be modified.

And then The Rec Board will also request the credit from the U.S. Army Corps of Engineers for Section 104. And under this category, the prime example is the

Natomas Basin Project. In fact, that project is on our March 16th Board Meeting, in which we will ask our board to approve the project and also send a letter to the U.S. Army Corps of Engineers asking their permission to modify that project.

And then the third category are the private sector or developer funded project modifications. The Rec Board issues an encroachment permit for these projects, and requests and coordinates approval from the U.S. Army Corps of Engineers for modification of the federal flood control project. That will be either done under Section 208 or Section 408.

And yesterday after finishing my slides, I talked to Rod and he came up with another category of projects, that in some rural areas where there are no local sponsors, the State may step up and fix the levees. So that's another category emerging to fix the flood control project or modify the flood control project. So new partnerships are emerging. And the Rec Board's role is to work with these agencies, so that when we modify the project that we are addressing this hydraulic impact issue wisely and keeping in mind the downstream user's impact.

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GENERAL MANAGER PUNIA: I think the purpose of today's workshop, as President Ben Carter mentioned, the

idea is to get the public input on this subject.

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GENERAL MANAGER PUNIA: The goal of the report is -- the overall goal of this report is to provide the information with which the Board and its staff can enhance the decision-making process for permitting the process. So it's an education for all of us. I think I have read Dr. David Ford's report a number of times. And each time going through this report I pick up new information, which I was not familiar. So when these complex issues are in front of the Board, we, as the staff, can provide the best information to the Board, so that the Board can make the decisions and the projects can move forward.

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GENERAL MANAGER PUNIA: And specific goals are to identify measurement standards or indices that applicants and the Board and its staff can use to identify and evaluate impacts.

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GENERAL MANAGER PUNIA: And the other goal is to identify options that could be used to prevent or mitigate adverse impacts.

To give some perspective on this complex subject, we have selected the best and the brightest in the industry. In my judgement, there's no better person than

Dr. David Ford to put this subject in perspective. Dr. Ford has the unique qualities of a professor and a practicing engineer, which is very rare. So with this, I will ask Dr. David Ford to make a presentation on this subject.

DR. FORD: Thanks, Jay.

President Carter and Board Members, my name is David Ford, David Ford Consulting Engineers. And our office is in the floodplain behind the levee here in Sacramento.

(Thereupon an overhead presentation was Presented as follows.)

DR. FORD: So we have a dog in the fight a little bit, I think. I'm here to summarize, give you a synopsis, if you will, of this report that has 18 words in the title and 80 pages of text. We did not get paid by the word. In fact, what we got paid to do was what Jay said and that is to outline some options and provide some information for you.

There's a real thin line that I have to tread here between presenting information to you and causing this to happen. When I look at out at the crowd, I know it's the middle of the afternoon. Some of you came from a symposium or a forum earlier where you had lunch. I saw a few people having a drink over there at lunch time too.

Shame on you. And I'll try not to put you asleep here as we go through this. There's a great risk of that, though, because as a number of you have pointed out to me, there is a lot of very complex technical information in that report.

And it's certainly something, I think, that we would welcome an opportunity to talk with any of you about. I don't know if this is the right forum to get into all that detail. If you want to, we can, but I think what I'd like to do is try and give you an overview at a pretty high level, maybe a 30,000 feet understanding that when we get to the point of applying these indices or the mitigation or prevention measures that we're going to have to get down pretty low to the ground to do that.

There are 3 points in this report. And the first point is that the things that we can do to improve the system may have some external impacts. And by external, I mean, at places other than where we make the improvements.

And the second point that's made in the report is that we have a lot of different ways to measure that impact. We've listed some. I think some of my colleagues here in the room may have ideas about other indices that we could use. And those indices range from purely hydraulic indices to economic and statistical indices.

I'm going to run through that list pretty quickly

here just to refresh your memory about what's in the report. The report does go into a lot of details. If you're really keen on seeing charts and graphs or equations, then some of those are in the report too. And I'm not going to burden you with looking at those today.

Sorry, Butch.

Tne then the third point that I want to make and it's made in the report is we've got some options for mitigating or preventing the adverse impacts. And we've got a little bit of a laundry list here. This laundry list of those options was developed by my staff, by the Reclamation Board staff, by DWR staff and by input from some of the folks that are here in the audience today. We had an opportunity to talk with a number of people as we developed this report for you. And there's an appendix to the report where we pretty much verbatim have included a transcription of what they said to us or if they provided information in E-mails or other documents, we've include that there for your reading.

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DR. FORD: Okay. So my first point then kind of back to what I started with, the levee system is evolving to protect lives and property. And I'm really glad that Jay made the point about considering a 50-year project life, because that becomes really relevant to some of what

I'm going to tell you and show you here and some of what's presented in the report.

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DR. FORD: The report goes through a little bit of an overview or a summary of how the project really was designed. And it's quite different from how we might design a project now, than a project that was designed 50 years ago or in fact longer than 50 years ago. Some of the design documents that are the basis for the construction of the project are actually dated 50 years ago tomorrow. And so the analysis, as you can imagine, that led to those design documents predated that by 10 or 15 years.

The design was based on looking at historical floods. And in this slide and in the report, there's a list of some of those historical floods, the 1907 flood being the last one. And as the design process through or progress through in both the Sacramento and the San Joaquin systems, the design was updated because during the process, there were floods, and so new data were incorporated in that design.

The design considered the flows from these floods and then water surface elevations were computed with hydraulic models. They weren't the same hydraulic models we used nowadays. It was the same set of equations, but

equations were solved in different ways. We had big columnar sheets with calculators and slide rules.

Do you member where your slide rule is, Butch?

VICE-PRESIDENT HODGKINS: Yes.

DR. FORD: We can do those calculations still. Joe Countryman and I were talking about this earlier. And from that kind of calculation, which incidentally is still consistent with what we do today -- we just do the calculations in a more efficient fashion -- water surface elevations were computed and that was used as the basis for setting the levee heights, and freeboard was added. That's the F word that we use here in this case. This is an additional amount of height that was added beyond the water surface elevations that were computed to account for the uncertainty in all the calculations and the uncertainty in how the system would perform. So the basis of the design of the system, historical floods, water surface calculations and then freeboard added to that

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DR. FORD: Here's an example, and I apologize to you and the audience that this is awfully small. But the original documents, gee, how big are they, Joe? Twenty-four by 36. Some of the sheets are even bigger because they're fold-out documents and these are the design profiles.

Now, there's about 3 things about this -- and incidentally in the report it's a little bigger scale. You can read it with your magnifying glass. But 3 important things about this. First, that this set of design documents that are the basis for construction shows a water surface elevation at various points along the profile of the stream. And that water surface elevation then leads to the levee profile or the levee -- top of levee elevation.

It shows a flow rate. And then the thing that I think is interesting, sort of as a historical perspective, is the little red circle that's in the right bottom corner, and that's the date on this particular sheet.

Joe, are you young enough to read that from way back there?

It says 15, March 1957. So tomorrow is the 50th birthday of the development of this particular sheet of the design of the project. There are not too many engineering facilities or engineering things that we've designed that 50 years later are still performing, I think, as well as this system is. So I think it's important to keep that in perspective. This is the way the system was designed. And the construction was based on that.

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DR. FORD: The design didn't focus on an intended level of protection. There was no idea that, oh, let's build a 200-year project or a 25-year project. Instead, the design focused on these historical events. And then after the levee profiles were set, there was almost a post-analysis done to determine what the level of protection provided by the project was.

Implicit in that though I think was an idea that there would be -- and it's pretty clear if you read through these documents -- that there would be a higher level of protection for the urban areas than for the rural areas. And if you go back through the design documents -- and there's a number of them that are all cited in our project report. If you go back through those design documents, you can see that after the fact the designers from the Department of Water Resources and the Corps of Engineers determined what the level of protection was at various locations in the system.

And that's what this table here is. It's an amalgamation of facts that come from those various documents. You can see the very top row that the urban area around Sacramento had a pretty high level of protection, a 200-year level of protection, at that time. Whereas, some of the rural areas had a lower level of protection, something on the order of 25- to 50-year level

of protection.

Once again, that's an analysis after the fact. It wasn't the basis of design. The basis of design was those historical flood events.

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DR. FORD: Here's a table that shows estimates of the current level of protection. This table is based on information that was from the comprehensive study that was sponsored by the Reclamation Board and conducted by the Corps of Engineers and the Department of Water Resources. And after the fact, using the design profiles, the levels of protection were determined for these various locations. And you can see now that in some cases the level of protection is higher than what it was thought to be at the time of the design. And in a lot of other cases it's lower than what it was thought to be at the design time.

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DR. FORD: Okay. So that's what was intended. There are some things that we can do to improve the level of protection. I think these are obvious to everybody in this audience. But just for completeness, I'm going to run through the list here, because there are 3 things that we considered in this report. There are a lot of things that we could do to improve the level of protection in the system that we didn't consider, and we didn't address in

this report.

We didn't address, for example, reservoir evaporation. Instead, we focused principally on things that would have to do with protection that's provided by the levee system. So the first thing that we could do that we considered here is levee raising. What that does is obviously increase the height of the levee. Increasing the height of the levee reduces the probability or the likelihood of overtopping and flooding the interior area. That's the direct impact.

The indirect impact of that is by changing the channel cross-section, the geometry of the stream, when we raise the levee, that it potentially can have some impact downstream. It could increase the flow rate downstream or it could raise the water surface elevation at a downstream location beyond the site downstream of the site where we provide this improvement.

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DR. FORD: The second thing that we could do is strengthening. Some of you, who got a flier from SAFCA, will recognize this nice picture. It shows what that amounts to. The idea here of strengthening is that we will do something to the levee to reduce erosion or to reduce seepage under the levee or through the levee. So, for example, we might add to it a cutoff wall like this

almost spike that's shown down the middle of the levee. What that will do then again is to reduce the probability of failure of this levee due to seepage. And reducing the probability of failure due to seepage is going to reduce the probability of water on the interior side on the land-side of this levee.

The indirect impact of that is that if the levee doesn't fail, then it could change the flow rates downstream, which in turn would change the water level and the probability of failure downstream at sites other than the site where this levee strengthening is put in to place.

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DR. FORD: The third option that we considered -- the third thing that we could do is levee relocation or realignment. Here's a simple illustration of what that amounts to. It amounts to moving the levee backward or away from the stream. And, in general, what is accomplished by that is that we lower the water surface elevation for a given flow rate. The downstream or external impact of that may be that it will change conditions downstream, change flow rates downstream or change water levels downstream or, in fact, it's possible that those water levels could be changed upstream, too.

So there's the intended direct consequence at the

site where the improvement is made. There's an unintended or indirect consequence upstream or downstream of that site, principally as a consequence of changing the hydraulics to flow in the channel.

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DR. FORD: Okay. So we have some options for how we measure those impacts, and that's really the first most important point of what we did that Jay had mentioned earlier. And we listed those options here. I'm going to run through this list pretty quickly. But as President Carter said, if anybody has any questions about those and wants some clarification, I'll do my best to help you out with that.

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DR. FORD: The first option that we listed is to measure the impact simply in terms of change in the water surface elevation or the flow conveyance or the system design flood or system design flow. And so this option for measuring the impact really is going to focus on that 1957 profile, if you will, the original design of the system. And it measures the impact simply in terms of change in the water level elsewhere compared to some baseline water level that's a consequence of the improvement that we construct at a given location. And we would do that using a mathematical model of the system

hydraulics. We wouldn't use the spreadsheets, the columnar sheets with our calculators and slide rules. Instead, we would use a more computationally efficient computer program, a standard and practice program presumably for doing this analysis.

One key to this is the idea of the baseline condition, against which we could compare this. I should mention that very briefly, because it is an important consideration here.

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DR. FORD: In this measure and all the other indices that we've listed that we're going to discuss here, we consider the baseline condition to be this, that it's a state of the system that's consistent with the intended design of the system. Like in a CEQA analysis, we're not going to consider the current case or current without-project situation. Instead, we're going to consider the design of the system. Any temporary condition, such as erosion, would not be considered as a part of that baseline condition and we would add to that any federally authorized system improvement. So things that have been done subsequent -- federally authorized projects subsequent to the original design of the system would be part of our baseline. So in every case we would be comparing back to that particular hypothetical state of

the system.

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DR. FORD: The second option that we've listed here is change in water surface elevation for flow of a specified probability. So this is a deviation from the original design of the system. Recall that I said the original design of the system wasn't focused on some level of protection. This option, very much like the first option, considers water surface elevation difference, but it doesn't use that 1957 design.

Instead, it says let's use the 100-year event or the 200-year event or some event that you would select as the standard for making this measurement. It would compute the water surface profiles for the base condition and for the improved condition for that event, and then it would compare those water surface elevations to declare or to decide if there was some change as a consequence downstream of the location of the improvement.

So these first 2 options are very much related. They both consider water surface elevation: One, the design event and the 2nd an event of specified probability.

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DR. FORD: I've shown this illustration. It's out of the report. It becomes critical to this

computation and this description and some other descriptions too. It's the way in theory or in concept we do much of the calculation that's done now.

We use a discharge probability function, which is Item A in this figure, that shows the relationship between frequency or probability of occurrence and the magnitude of the flow rate. So if we're going to use the measure that we've identified here, as measure number 2, we would find the 100-year flow, let's say just as an example, then we would use Item B here, the relationship between the discharge and the water surface elevation to find the corresponding water surface elevation.

Now, Item B might be as simple as we've illustrated here or it might be more complicated. We would use, instead of a computer program, a mathematical model to solve that in more complicated cases.

I want to call your attention to Item C in this illustration here, because that becomes relevant to some of the other indices that we've identified here, and that is the relationship between the water surface elevation in the floodplain, in the event of a levee overtopping or breaching, and the damage that would be incurred. We can develop this kind of relationship by doing an inventory of structures in the floodplain using predictive functions that are developed by the Flood Insurance Administration

or the Corps of Engineers to make an estimate of what the potential damage would be if we had flooding to different levels or different depths within the floodplain.

So this becomes key to a number of the other indices, where we consider economics as part of the measure of impact.

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DR. FORD: Okay. So that brings us then to the third index. And the third index says let's consider the change in potential damage for the system design flow. Now, as the system was designed, there would be no damage, except for events that overtop that design event.

But if we consider the uncertainty in the performance of the levees, there may be cases where there would be a breach of the levee at an event that's less than the design event, and that could be accounted for in this particular case.

And so this index says we'll consider the flow, we'll consider the water surface elevation, but we'll take it one more step and we'll consider the damage that would be incurred in the floodplain, the area protected by the levee, in the event that we had overtopping or a breach of the levee at the design event.

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DR. FORD: I've noted here that we would use a

mathematical model for the system hydraulics to compute that. And you'll see that as a common thread through all of these measures that we've listed here, that the hydraulics model becomes very much important to any of these calculations. But we add to this also a model of the potential damage. Presumably, we would follow the standard of practice, which has been set by the Corps of Engineers in their flood damage reduction studies. And so procedures for doing that damage calculation are well known and promulgated by the Corps of Engineers.

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DR. FORD: We could also add to this consideration of the performance or the uncertainty in the levee performance. As a part of flood damage reduction studies now conducted by the Corps of Engineers and also potentially as a part of their levee certification program, they're now considering the uncertainty on how a levee would perform.

And so instead of saying well, it's going to carry water until it's overtop, they will develop a curve or a relationship, as the one I've shown here, that has probability of failure due to breaching as related to the water surface elevation on the stream-side of the levee. And so that's a way to represent our uncertainty of the performance of the levee and that could be included in

computation of this index. And incidentally it could be include in a computation of any of the subsequent, we've discussed indices.

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DR. FORD: The 4th index is a change in the potential damage for a flow of specified probability. So index number 3 said let's look at the damage that's related to the design event. This index says let's look at the damage potentially that would be related to some selected event of a specified probability. So if, for example, we decided to use a 200-year event as our standard for measuring this, then we would look at locations throughout the stream system and estimate the damage for the 200-year event and use that as the basis for determining whether there's an adverse impact as a consequence of any proposed measure.

So this index then uses those functions that I had illustrated in the previous set of charts that I had, where I had a full probability relationship, I had a stage versus flow relationship, and then I had a stage versus damage relationship. This says let's pick the one event we're interested in, the 100-year, the 200-year, the 50-year, whatever that might be, and let's estimate the damages that would be incurred. And if the damage increases as a consequence of any improvement we make,

then we would declare that to be an improvement that had an adverse impact downstream.

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BOARD MEMBER BURROUGHS: Or upstream,

DR. FORD: Or upstream. Yes, ma'am.

Okay, Index number 5 that we proposed is an index that's based on standard computation of flood damages. It's an index that uses something called the Expected Annual Damage or EAD. Expected Annual Damage doesn't just consider the 50-year event or the 100-year event or the 200-year event, it considers the entire range of events. It computes the damage that's associated with each one of those and it weighs that damage by the probability of it's occurrence.

And so it's a long-term average damage. This index is the standard that's used by the Corps of Engineers, for example, when they make a determination of whether there's a federal interest in a flood damage reduction project. They will compare this expected annual damage with the benefits -- I'm sorry, with the cost of the project in making their determination of benefit cost ratios.

So if you've used this index here in making a determination of whether there's an impact off-site of a proposed improvement to the system by computing the

expected annual damage for the system downstream, both with and without the project, taking the difference of those 2, and if we see that the expected annual damage increases, then we can make a determination that there is an adverse impact of the proposed improvement.

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DR. FORD: The 6th index that we propose is related very closely to the 5th index. It uses statistics or a statistical analysis of flood damage potential, except it says let's not worry about any damages less than the design event. Let's consider only damages, expected damages for events greater than the design event, so if you will, partitions that expected annual damage. What this would mean, for example, is if I construct a project that somehow raises the water surface elevation for an event downstream that's less than the design event, let's say I raise the water surface elevation to the 25-year event, this index would show no change. It would say, gee, we didn't have a failure, we didn't have any damage from the 25-year event before, and if I put this measure in place and it increases the water surface elevation for the 25-year event now, there's no change. It considers only events that are greater than the design event that was shown in that 1957 profile, for example.

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DR. FORD: The 7th index that we've proposed here is a change in the annual probability of inundation of the interior floodplain. And I guess my second bullet point here is really the key to this. This is what most of us used to know as level of protection. And so this says if I do something to improve the system and it increases the probability of flooding downstream, then this is the index or it changes the probability of flooding downstream, then this is the index that I would use.

And so if, for example, I raise a levee and downstream it changes the level of protection from 1 in a 100 to 1 in 95, then this is the index that would show me that. And it gives me a clear indication, from a statistical standpoint, of the risk of flooding without any reference to the damages that would be incurred or the consequence of that increase and the risk of flooding. So it's purely a statistical index if you will.

And, again, I made the point here in the last bullet that this index can account for uncertainty of levee performance. And so we can track that statistical or the probability of the levee failing to carry water as we move down the system in this computation.

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DR. FORD: Okay. Just for a little levity here, I've included a cartoon, because it becomes really

critical to us, I think in some of this analysis and some of the subsequent analysis to recognize that, much as we engineers would like to pretend that we know everything with certainty, there's not very much that we do know with certainty.

And a lot of these statistical analyses, especially the ones that include what we've called risk and uncertainty, or what the Corps of Engineers has called risk and uncertainty, make this kind of determination. They say well, we've got the statistical tools to acknowledge that we don't know, for example, what exactly the 100-year flow rate is. There's some uncertainty about that. And it depends on how we make our estimate of that 100-year flow rate. It depends on the sample size that we have, do we have 100 years of record or do we have 10 years of record? And we can actually model that uncertainty.

And so many of these indices that we've proposed and the ones that we're going to propose here in just a minute, the next couple, really focus on doing some sort of propagation of that uncertainty through the calculations.

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DR. FORD: Okay. So Item number 8 or index number 8 that we've proposed is an index that measures the

change and probability of passing safely the design flow. The intent of the design was that we would always pass safely the design flow, and the levees we're constructing with that idea. No engineer would build a levee with the idea that it wasn't going to pass safely the design flow.

But the fact is that as the system has aged, we can't make that declaration. And so we know that there is some uncertainty about how those levees will perform. And this index says let's model that uncertainty, let's take that design flow. And at any given location, let's consider the assurance that we can make that we would pass that design flow.

And if a measure that we propose somehow reduces that assurance downstream, then we can say that our measure had an adverse impact, because it's reduced the probability that I'll be able to pass safely that design flow from that 1957 profile.

MR. WASHBURN: David, I do have a question.

PRESIDENT CARTER: Would you please identify yourself for the record.

MR. WASHBURN: Tim Washburn from SAFCA. How is this an indirect effect on another part of the system? So you strengthen the levee in one place reducing the probability -- or changing its probability, making it less likely that it will fail the design flow at that location.

How does this measure anything away from that location?

DR. FORD: I'm not sure I can restate the question, Tim. Were you able to get it?

THE REPORTER: I got it.

DR. FORD: Not every index, Tim, is going to be applicable in every single location, but if we somehow strengthen the levee at an upstream location, then that strengthening upstream whether it's intended or unintended may put more water on the downstream site.

MR. WASHBURN: No, but this is just the design flow.

DR. FORD: Oh, I'm sorry. Okay, so in this particular case, only if it raises the water surface elevation at the downstream location would it have any impact on this. Yeah, because it the consistent design flow. So if my improvement has some impact on the downstream or upstream water surface elevation, that's the only way that it would have a change in this case.

DEPUTY DIRECTOR HARDER: Les Harder from the Department of Water Resources.

Just a clarifying question, when you do that calculation for the one you just talked about the design flow, are you cranking into the probabilities the probability of upstream failures that might relieve the stage for a certain flow or not, or are you assuming that

they are completely intact and passing the design flow as designed?

DR. FORD: Yeah. Les, I don't think the microphone was on.

(Laughter.)

DR. FORD: But his question is what are we considering the upstream state of the system to be?

And I think, Les, that my answer to that is that our baseline condition presumes that the system upstream of the site at which we're going to provide the improvement, that the system performs as designed. So there were no upstream failures for flows that were less than the design flow rate. And that's consistent throughout all of these indices. Our baseline condition assumes that the system performs as it was designed. In fact, the State of California has made an assurance to the Corps of Engineers that it will do that. And so that's what we've assumed in our baseline condition.

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DR. FORD: Okay. Did I skip one here?

I'm working on 9.

All right, let's see, I'll scroll down here and find our slide.

Here we go. All right. So option number 9 is related to that previous option, except this option says

no, no, not the design flow but a flow of some selected probability. So, for example, if we decide our standard is the 200-year event, then this would consider any changes downstream in the level of assurance, if you will, the probability that we would safely pass that selected target event, very much in the same fashion as the other would consider uncertainty both in our ability to estimate that flow rate, uncertainty in our ability to estimate the stage that's associated with the flow rate and also the uncertainty in how the levee would perform.

Some of these indices make a lot more sense when we consider the uncertainties. If we simply take the strict interpretation of the frequency curves and the rating curves and the levee performance, then these indices are less informative. But if we stir in the uncertainty about how all the system features will perform and about our knowledge of that, then these indices do become much more informative.

So that's index number 9.

Joe.

MR. COUNTRYMAN: I've got the same question Les asked on the last one. In this method, how does it address the possibility of upstream levee failure?

DR. FORD: Again, the baseline assumption is that levees upstream will safely pass their design event.

MR. COUNTRYMAN: Well, this isn't a design event.

DR. FORD: I understand that. But the design event upstream does have some probability associated with it. And so this measure would say whatever that is, if the upstream levee could pass a 200-year event, then everything up until the 200-year event would be holding water to the top of the levee. There would be no failures for less than whatever our selected probability is, if that's less than the design event.

MR. COUNTRYMAN: What if it's more than the design event?

DR. FORD: Well, if it's more than the design event, then I suppose that we have to make some collective determination about whether we assume that it fails or it simply overtops and caries water over the top.

MR. COUNTRYMAN: So that's to be determined?

DR. FORD: I think it has to be determined. And, in fact, there are a number of things in this that I think that collectively as a community of hydrologists and hydrologic engineers and attorneys and elected board members or appointed board members, we have to make that determination. We haven't answered every single question here. No question about that.

GENERAL MANAGER PUNIA: Please identify yourself. And the person asking the question on that was Joe

Countryman.

DR. FORD: Okay. So the next set of options that I want to discuss for preventing or mitigating -- but before I do that I think that we need to stop here and talk a little bit about some practical considerations, because it's really easy to say oh, let's do these things. But the fact is that at the end of the day somebody has got to go back to their office in the floodplain and do them.

And so I think that it's appropriate to remind you that we address some of these in the report. Probably the most important practical consideration is the need for hydraulic modeling software that we can collectively agree does a good job of representing the system.

The way that the analysis has been done to date has been mostly a combination of work that's been done by the Corps of Engineers, Department of Water Resources, local consultants taking those models and improving those. And they move back and forth, I think, very much in an open sharing fashion. But nonetheless I think that it's imperative that if we're going to do this in a consistent fashion moving forward, that we've got to agree on the mathematical model to use, and there has to be some procedure or some method for maintaining that model in a state that's an adequate, almost RealTime, representation

of the current state of the system. So I think that that's really a very important thing.

The second thing is that in the case of this risk and economic analysis, if we're going to adopt one of those indices, then we have to find some software that we can use in a reasonable fashion to do that. The standard of practice at this point, right or wrong, is a computer program from the Corps of Engineers. They use that as the basis for their risk and economic analysis. Whether or not that's an appropriate tool for you to use in making your determinations, I think is probably subject to some debate.

The Corps of Engineers has, as a part of their program, enhancing and improving that particular piece of software. That activity is underway, but I think at this point it's known to have some deficiencies.

The third point here is that some of these indices require a lot more data than other indices. If, for example, we select an index that says let's look at the design event and compare differences in water surface elevation, then the data requirements for that are substantially less than data requirements, if we said let's look at the expected annual damage. If we were going to look at expected annual damage, then we're going to have conduct and develop inventories of damageable

property in the floodplains in the central valley that are protected by the project and we'll have to use that as the basis for our calculation.

And my colleague, Steve Cowdin in the back of the room there from the Department of Water Resources he can testify with me that that's not a trivial task, that there's a lot of effort there to do that kind of data collection and data analysis.

The 4th point is that the expertise required to do some of these analysis, to use some of these indices goes beyond that which is required to use others. The ones that, for example, are based purely on comparison of water surface elevations require kind of standard hydrologic engineering analyses and expertise. But if we go beyond that and try to incorporate the risk analysis and economic analysis, then we ratchet up the level of expertise and experience needed to do that kind of calculation.

That's not to say that we shouldn't do it because it's hard. Calculus is hard and we still do that from time to time. But nonetheless, we need to recognize that this is a more difficult calculation.

The next to the last bullet there is that in any of these it becomes a matter of considering system-wide impacts, which is a chore, because upstream improvements

may have an impact very far downstream, even to the Delta. And, in fact, if we look at some of the original design documents of the San Joaquin project, we can see that some determinations were made about setting levee heights with consideration of what that would do downstream to the Delta. And I think that that standard has been set for us. And so in whatever we do here and whatever indices we choose here, we really have to consider system-wide impacts, tracing downstream and upstream whatever the hydraulic and economic and statistical impacts of our measures would be.

And then the last point is a point about computational tolerances. I think, as much as I hate to admit it, models are not perfect. Models are subject to round off. And we need to be careful or you need to be careful as a Board, I guess, in setting a standard for what an increase, for example, on water surface elevation is. If we compute a change in water surface elevation of a thousandth of a foot or a hundredth of a foot or even a tenth of a foot, is that a real change in water surface elevation?

And we know, those of us who use models know that if you change any input to a model, it's going to show you some change in the output from the model. And we need to do be aware of that as we make the selection of these

measures and make a determination of what a significant change is for whichever one of the indices we choose.

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DR. FORD: Okay. So now we have some options for preventing or mitigating those impacts. And I want to run through these options. Some of them are obvious and we've included them here mostly just to have a complete set, if you will.

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DR. FORD: The first one is the most obvious and that is if it has an impact don't do it. And, of course, the downside of that is if we don't do it, then there's all sorts of ramifications in terms of stalling or stopping improved protection and development and intensification of use within the floodplain.

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DR. FORD: The second index, we listed here, and again this one might be a very difficult one to implement, is to mitigate the impacts with some sort of other structural measure. Sadly, we're dealing -- I don't know if it's sad or not -- but we're dealing with a system where, for example, we couldn't build easily another reservoir to control flows. And that would be, for example, in some cases a likely structural measure that would reduce downstream impacts. And so even though it's

certain within our tool kit, it may be very difficult to implement in this case.

And the downside of that too is that by mitigating one impact for economics, for example, if we raised the water surface elevation, we're creating yet another impact, perhaps an environmental impact, that we're not willing to sustain.

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DR. FORD: The third option is, and this is something that we already do, is notify those who are going to suffer as a consequence of that adverse impact. This does allow continued improvement, but as I noted in my last bullet here, it doesn't fix any problems potentially, because we're still going to have increased flow or stage or risk at the downstream location as a consequence of whatever measure we permit.

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DR. FORD: The 4th option is to reimburse those who suffer the increased damage potential. And that reimbursement could take several different forms. If we use, as our standard for example, the damage that's incurred by the 200-year event, then this index or -- sorry, this mitigation measure would say let's use that as the standard. Let's see what the additional damage potential for that 200-year event would be and let's

reimburse those who suffer that damage.

Or if we decide to use the expected annual damage, that probability weighted damage, that considers all of the events, then we could use that as the basis for determining this monetary reimbursement.

What I've noted here is that still this doesn't stop the damage. And so this is a case where the damage may increase, we may compensate those who suffered it, but the damage is still there.

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DR. FORD: The 5th option we listed here is to ensure those with increased damage potential. So rather than compensating them on the basis of we think damage may happen. This says let's wait until it does. And so if there's an increase then we'll provide insurance to cover the cost of that increased damage. And it doesn't eliminate the impact, it considers only direct tangible cost. It doesn't take care of, for example, loss of life or risk to humans. But on the other hand, it does allow us to continue with the improvements.

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DR. FORD: The 6th option here says let's collect an impact fee to offset the increased construction costs for a system-wide plan of flood control. And so this goes to a topic some of us heard discussed this morning and

that is the State Plan of Flood Control. This uses the State Plan of Flood Control as the standard for what we'll do to mitigate the impact. If a project somehow increases the cost or the State to achieve the State Plan of Flood Control, then this mitigation measure says, pay the difference that the improver, if you would, should pay whatever increased difference there is or increased cost there is as a consequence of their measure in terms of the overall cost of the State Plan of Flood Control.

But again this is something that doesn't eliminate the impact either. There's still going to be higher flows or higher water surface elevations or greater risks at the downstream location.

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DR. FORD: Number 7 option, pay the cost associated with any increase, if and when it occurs. This is probably not an option that most of us would like, because it says let's just wait and see. And if nothing happens, then we don't pay. And if something happens, then we do pay. It sounds like a lawsuit, I guess. But nonetheless, it's an option for offsetting the increased economic cost that's associated with an improvement.

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DR. FORD: Option number 8, it says provide other types of insurance. Maybe assurance is a better word for

this. This option would purchase or lease flowage or storage easements to ensure that we would offset the impacts of a proposed improvement.

And, again, this one would actually have a physical impact, because it could reduce the water surface elevation or it could reduce the flow rate or the risk associated with flooding, but it could also be very costly and very difficult to implement. So we need to recognize that

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DR. FORD: Okay. So those are the options. We're still left with this, a can of worms. But I think my points are that things that we do to the system are going to have an impact throughout the system potentially. We've got a handful of ways including those that we've listed here and probably some that you'll hear from my smarter and brighter colleagues in a minute, for measuring that. And we've got a handful of ways that we can either prevent or mitigate that impact, regardless of which of those indices we choose.

So with that, I think shall we take a little break or shall we take some questions, what's your preference?

PRESIDENT CARTER: Let's take a 10-minute break.

DR. FORD: Okay. So the message was we'll take a

10-minute break. I've got 10 minutes after the hour, so that means we'll start at 20 minutes past 3:00.

Thank you.

(Thereupon a recess was taken.)

PRESIDENT CARTER: Ladies and gentlemen, if we could ask you to go ahead and take your seats, we'll reconvene.

Thank you. At this time, what we'd like to do is entertain any and all questions about the report, about the information that Dr. Ford has presented from any one of you in the audience. What we do ask is that you please use a mic. Lorraine is over here on your right and Dan is over here on your left. They each have microphones. If you want to ask a questions, please raise your hand, they'll bring you the mic, identify yourself for the record and then we'll charge ahead.

So with that, we'd be happy to entertain any questions. Please raise your hands.

BOARD MEMBER BURROUGHS: Lorraine, I have a question.

BOARD MEMBER DOHERTY: Dan is right there.

BOARD MEMBER BURROUGHS: Thank you for your wonderful presentation. Throughout your presentation you use words like "may" or "assume". And I just wanted to know, also with those 2 words, you also talk about

software needing to be developed and also a standard of information or data that's going to be part of the software package. Where and how long would it take to get the software that you think would be acceptable?

DR. FORD: I'm not sure where I used the words "may" and "assume", but so much of this -- just to qualify them, so much of what we do in hydrologic and hydraulic and economic analysis and statistical analysis is uncertain as we've noticed here. And so I think in some cases the only word that we can use is "may".

In particular, for example, when we talk about changes in water surface elevation as a consequence of some construction, I think I said it may change upstream or it may change downstream. And we can only make a determination on a site-by-site basis with one of these mathematical models.

The second part of your question was about the mathematical models, about the software in particular. And I think -- and there are 2 types of software that are really key to the indices that we've identified here. One of those is the channel model. The model of water surface elevations and flow rates and diversions and so on. And, for the most part, the software to do that analysis is available. There is a standard of practice, a piece of software called HEC-RAZ that's developed by the Corps of

Engineers at their lab in Davis. That I think for the most part now is the standard of practice for these analyses. It's used by the Corps, by the Department of the Water Resources, by all local consultants and public agencies.

So there's no development of software necessary there. It's more a case of developing and maintaining a database that's got all the appropriate input to that piece of software, so, for example, a good database of geometry of the channels, what do the cross sections look like. And with every successive study that's done by any agency we get more and more information, because we have an opportunity to do additional surveys, to determine what the bathymetric data looks, but also to do things like survey the levees where really the top of the levee is.

So that's where the effort there is. It's not os much an effort of developing new software. We don't have to go to Microsoft and beg them to do a Vista things for us or whatever. But instead it's a case of just working as a community to get the data set together and to maintain that data set, so that it doesn't fall out of clear and good representation of the current system.

The economic analysis and risk analysis software, there is software available. Again, it's software from the Corps of Engineers. This one is called HEC-FDA for

Flood Damage Analysis. And there is a version of that program that's available right now that is used by the Corps and the Department and by applicants. And that piece of software is one that is under improvement, shall we saw. And a new version of it is expected any day now. I don't want to speak for the developers. I couldn't tell you when.

But I think that not a lot of effort is available, again, to develop the software. It's more an effort to gather the data and to maintain that data in a state that represents well the current system.

Does that answer your question.

BOARD MEMBER BURROUGHS: Yes, it does. Is there a mechanism right now for other agencies or other engineers to have one home place to send the data to?

DR. FORD: No, not that I'm aware of. I don't know, is there anybody from the Corps here? I didn't see anybody from the Corps of Engineers here. I think -- pardon me?

MR. WASHBURN: I was making a joke, why would they be here?

(Laughter.)

DR. FORD: I think the Corps of Engineers developed a system-wide model -- actually, it's sort of in pieces -- as part of the statewide -- or the Central

Valley Comprehensive Study. And when that study took a sabbatical leave -- is that an appropriate word. I don't want to say it died, but that's --

(Laughter.)

DR. FORD: It took a leave. The models sort of went into limbo. And so presumably that would be the place to start to pick those models up. And I think, and maybe some of you know better than I, that there is actually some effort under way by the Sacramento District of the Corps to pick those models up and to get them in a state that would better represent the current system.

BOARD MEMBER BURROUGHS: Thank you.

MR. COUNTRYMAN: I'd like to just add to that answer.

PRESIDENT CARTER: And your name.

MR. COUNTRYMAN: Joe Countryman, MBK Engineers. I think the point that you'RE raising is imperative. I know we obtained models from the Corps. We did work on calibrating, improving the calibration and so forth. And then we give them maybe to the Rec Board and we have the Corps review it and then somebody else does some work.

I really think one of the things that could really come out of this that would be very helpful is if we had a State repository for the approved hydraulic model that's currently got everybody's blessing that we could

use and feel some confidence that we're using the latest stuff. So I would like to see that actually come out of this.

Thank you.

MR. COWDIN: Thank you. Actually if you could add to that, I think DWR can --

PRESIDENT CARTER: Your name.

MR. COWDIN: I'm Steve Cowdin, Department of Water Resources. I'm an economist. That we are looking at trying to update the Comp Study Models. And I think we were heading in that direction, at least I hope we're heading in that direction. I don't see Rod here at the moment. He perhaps could answer that better than myself.

To go back to some of the questions earlier about how do we take into account, you know, hydraulic effects upstream or how do we use these indices, you know, downstream beyond our impact area? I think Tim was asking that question.

It really comes into how we define the study area. If we design the study area as just our agency, then those these questions become very hard to answer. If we define our study area perhaps as a river basin and have lots of impact areas along the river basin, then we can track changes from upstream all the way downstream, using that data or other models. We did that with the Comp

Study. We could track changes due to levee sizing improvements, due to off-stream storage or whatever.

So there are ways to use these models to look at effects upstream as well as downstream of your community.

BOARD MEMBER BURROUGHS: Thank you.

PRESIDENT CARTER: Any other questions?

Comments?

VICE-PRESIDENT HODGKINS: Butch Hodgkins, Board Member.

David, the summation of the models is fascinating, and you know I love them, but I quickly get lost in them in terms of what they really mean. Is it possible for you not to tell us about the models, but in effect to try to articulate policy issues in an understanding way that would let the Board deal with the policy issues. And once we've decided what policy we wanted to follow in terms of hydraulic mitigation, be able to turn it over to the engineers to translate it into a model? Could you do that, do you think?

DR. FORD: Let me restate your question, Butch, just to be sure I understand it. But I think the question is if the Board establishes a policy to use one of these indices or some combination of these --

VICE-PRESIDENT HODGKINS: (Shakes head.)

DR. FORD: No. Okay, then I don't understand

your question.

VICE-PRESIDENT HODGKINS: Suppose we start with a policy that said, you know, fundamentally we think that as a promise to the beneficiaries of the projects in the central valley has been to provide them with the designed level of flood protection. And from there went on to say that any impact that potentially increased the risk of flooding at less than the design elevation was an impact that had to be mitigated. But impacts that potentially only affect risks of flooding above the original design level were impacts that don't have to be mitigated. Could you deal with that in terms of modeling and coming back and telling the Board what kind -- whether the project had an impact that was significant or not?

DR. FORD: My answer to your -- okay, this is David Ford again. My answer to your question is yes, that we have the tools available to do it. Now, that's not to say that it's going to always be a trivial thing to do, but I think the engineering community has the hydraulic models available to do that.

VICE-PRESIDENT HODGKINS: Okay. But it seems to me answering that question would not involve going down this risk of uncertainty path.

DR. FORD: I think if that's the decision that you make, that that's true.

VICE-PRESIDENT HODGKINS: Okay. So you, in effect, see risk and uncertainty in terms of incorporating that into our modeling or not as a policy decision?

DR. FORD: I'm not sure that I would put it quite that way, Butch, because the decision, for example, to use freeboard as opposed to risk and uncertainty analysis, I guess, is a policy decision. In the end, the scientists and engineers amongst us might disagree about that. And so I think that disagreement then has to be mediated by you making a policy decision. Does that make any sense?

I mean, I've always for every Ph.D there's an equal an opposite Ph.D. And I think that this is a case of that.

VICE-PRESIDENT HODGKINS: You can extend that to engineers, if you want to and attorneys, Mr. Washburn.

All right. Thanks, David.

MR. ESTES: My name is Gary Estes. Rod is back in the room, and I think there's a data point that needs to be clarified about the status of updating the hydrology from the Comp Study. And you probably have that answer, Rod.

DIVISION OF FLOOD MANAGEMENT CHIEF MAYER: We will be updating the hydrology.

(Laughter.)

DIVISION OF FLOOD MANAGEMENT CHIEF MAYER: That's

part of our plan for the new State Plan of Flood Control. Everything hinges on having accurate hydrology that everybody can agree to. We're asking the Corps of Engineers to do that work. We're developing the contract. We've drafted scopes of work for that. So the answer is, yes, we are revisiting that. We will develop new hydrology, up to a 500-year event. And the Corps will provide the input to the valley at various locations that we'll agree upon. I think we already have the agreement on those points. And then the models will take those input hydrographs and run them through the system. We think that will be about a 2-year effort for the Corps.

MR. COUNTRYMAN: Why about updating the hydraulic models.

DIVISION OF FLOOD MANAGEMENT CHIEF MAYER: Separately.

PRESIDENT CARTER: Do you want to repeat the question, please?

DIVISION OF FLOOD MANAGEMENT CHIEF MAYER: The Question had to do from Joe Countryman regarding updates of hydraulic models. We are developing consulting contracts that will develop the models for the system. And I think that's going to be the vehicle for developing the new system models that we'll use for developing new State Plan of Flood Control, doing the alternatives

analysis and for all of our mapping projects.

MR. ERES: My name is Tom Eres. I'm just a poor country lawyer trying to get along. There's not too many of us out there.

My comments are comments as opposed to questions, because there's an awful lot of very bright specialized people here. I want to go back to Jay's comment, "a paradigm shift". I want to pick up on your comment, Butch, in terms of policy and where the Reclamation Board fits in trying to set the parameters for those of us who represent the people out there, who are the recipients of the decisions that you make in approving projects and imposing conditions.

I used to teach a little bit, and I posed a formula, I plus S equals E cubed. Integration plus synchronization equals effective, efficient execution. And what you were talking about, the paradigm shift, I think does that.

And what I mean by that is, this report, sir, that you prepared I consider to be quite refreshing, and I thank the Board and the DWR for commissioning it, because you're concentrating system wide. And it's just replete through the entire report, look at it system wide, not project by project, not piecemeal by piecemeal, system wide.

And that leads us quickly into cumulative impacts. And that is a 4-dimensional analysis in my view as to what you mean by cumulative impacts, because you've laid out some components, hydrology, hydraulics, economics, damage, there's other components to it that may be fall under equal protection health, safety and welfare.

I would also suggest that you've done an excellent job in I think trying to set the stage that for every consequence there's a potential unintended consequence or, if you will, an indirect consequence. And I think it's important for the Board in developing policies that there be a thorough analysis as much as you can as to what are those unintended consequences. Because if you go ahead and take a look at one project, and allow it to go through your permitting, but you haven't fully understood the entire process and the system, upstream, downstream, whether it's an inundation inland on the other side of the levee or otherwise, and the fact that it all works together in some fashion.

I was impressed with the findings on page 7, the indices and impacts on page 8. I thought, again, your 9 indices were -- I mean, it's something I could understand. And I particularly thought that there was a lot of counsel in some of those notes from the stakeholders that you included in the appendices, particularly Fran Borcalli,

SAFCA, Mike Hardesty just to name three of them.

But again I'm left with this sort of a sense that with all the computer models, you've sort of stated it -- I'll be crass and say junk in, junk out. And when you say we're defining what we want to accomplish in the future in terms of 25 year, 100 year, 200 year, I don't know what those mean. I've asked more engineers than Carter used to have peanuts whether the 1997 high water event that took place in California was a 100-year event. No one will say it was a 100-year event. They'll say well, it's closer to a 100-year event than the 1986 flood. That's a statistician's answer to a question.

But again, those standards mean nothing to me. Design flow and design capacity do. And if you set by policy what it is you're looking for in terms of your system along those metrics, so that some of us out there can understand them, that makes more sense than the euphemism, and I call it sort of a bate and switch if you will in terms of 100-year and 200-year. You talk 200-year unless you have to have a certification, in which case you go to the Corps of Engineers and it's a 100-year because they don't have a 200-year.

And you take a look at FEMA, and then what is FEMA doing with respect to certification? Well, they don't. They accredit. And you're looking out there on

behalf of public folks, and you say well, all right, I think I understand it. No, I don't.

And so at the end of the day what your report has done, I think, has teed the ball up appropriately and correctly for further deliberation by the Board to see if you can help some of us out there with again respect to the equal protection of health, safety and welfare of the California Flood Plan, because it is complex. It's hard to understand. And when we try to take and advise folks in terms of what their courses of action are in dealing with projects or in dealing with trying to protect their property, you can get lost real quickly. It's truly a bramble bush.

And I liked your comment sir about saying well, we're studying all this by looking at the floods that were in the past. Well, that reminds me of the admiral trying to chart a course for the ship by looking at the stern and trying to figure out where to go, and in the fog missing that light, which is really a light house and not an oncoming ship.

It is complex. And you can imagine if you're the expert trying to explain it to us, the non-expert, I would get lost in it. And we're not exactly sure how to input to the Board where our concerns are, other than to say equal protection, health, safety and welfare. Let's make

sure we're all playing with the same deck of cards, the same metrics and we understand the same end state.

Thank you.

PRESIDENT CARTER: Thank you.

MR. STORK: Ron Stork, Friends of the River Conservation Staff.

I don't exactly know how to respond to this conversation, other than it's a very important one, because I think Jay is very correct. It's very hard to know how to do either the comprehensive -- implement the on -- on leave, comprehensive study or the money that you've just got in the new propositions without dealing with these hydraulic mitigation issues.

If I have a thought, it's that you need to find something that's functional. If you choose some hydraulic mitigation standards that are impossible or so complex to implement that they can't be implemented, you're going to not be able to spend this money and undertake the projects that the voters and you want to develop. So this is an important conversation.

I have a number of quick thoughts. And one is about some proposals that David had about, well, maybe your standards should be if you increase the level of risk, either at the design flood or at some given level of protection, to some downstream or upstream area by

constructing a project.

And what I found most intriguing was well, what about the consequence of that? Well, we'll pay for the losses. And I think that's an interesting concept. But if say you have a levee system that's capable of, say -- has a 40 percent reliability for any particular design flood and you have calculated a -- not necessarily, this may not be true. I mean, you've calculated an impact of say 1 percent and now it has a 41 percent chance of -- sorry, 39 percent chance of handling that design event, and you decide well, because of that 1 percent we're now going to indemnify this area for the damages that occur there, it seems to me like a rather disproportionate response to the impact that's just been actually incurred. I have no idea whether or not that flood was caused by the existing risk or the added incremental risk.

So I think you're going to wrestle with these standards and your attornies are going to wrestle with these standards and lawyers are going to be wrestling with these standards. And these are going to be challenging to figure out how to work on.

But as I said, I think this is an important discussion and you need to land in a place where you can come up with some practicable, workable approaches or you'll never get anything done.

Just kind of in conclusion, I think that you may want to reflect on the fact that there may be different worlds here. If you look at the kind of the basic analysis for how the flood control systems in the San Joaquin valley work in comparison with Sacramento valley, I think many of us had noted that floods in this San Joaquin valley, large floods, break the levees. And that's really a design feature of that system. And, in fact, the downstream communities rely on the upstream communities' levees being broken.

And I don't think that's -- that's far less true in the Sacramento flood control system, which is a much more integrated system, where the anticipated levee exceedances are much less, than the almost guaranteed flow exceedances that happen in the San Joaquin system. So it's -- it may be helpful. And I know it increases your complexity. But it may be helpful when you deal with the real world, when the Reclamation Board deals with the real world to try and recognize what the design philosophy of the systems are, because that's -- that hopefully reflects the expectations of the communities that are affected by your decisions.

Thanks.

MR. SHAPIRO: Good afternoon. My name is Scott Shapiro. I'm General Counsel for the California Central

Valley Flood Control Association. And while my comments haven't been vetted by that board due to the short period between the review of the draft report and this meeting, the general tenor of the comments do have the support of the association. We intend to bring comments back to the association board for more official vetting and more detail.

I guess I want to preface my comments by noting that I and I think the association completely support the notion of determining whether there are hydraulic impacts associated with the projects that the Reclamation Board approves. And there doesn't seem to be much opposition to that. We all hope that we're on the improving end of things and thus not receiving impacts, but there are times when we're on the receiving side and we want to make sure those impacts are being considered.

But the question really, I think, goes to the issue of how we're going to measure them. Indeed, that's why David's report is so useful, because it presents a great spectrum across which we can look. So I'm an attorney and not an engineer. And my comments on the report likely have a different focus than other commentators because of that.

And I'll note that it's important to consider the reason for the analysis contained in the report. The fact

that the report was commissioned suggests there's a need for it. And there certainly is a need to make sure there is an analysis methodology that's accepted.

But what the report really doesn't do is analyze the currently accepted methodology for measuring impacts or explaining why the current accepted methodology might be suspect or perhaps should be changed. Similarly, the report does not explain what events culminated the need to generate the report and consider changing the current accepted methodology for mitigating impacts.

And while my comments might seem unduly procedural, I strongly suggest the Board not ignore the very basic question of why we're engaging in the activity. That question of why deserves consideration from a legal perspective as well.

As I noted in my comments, which were contained in the appendix to the report, I believe the Board should consider the context in which the question of measuring impacts arises. In other words, the reason why you measure impacts might be different depending upon the obligations that you're satisfied. And the extent to which the Board is reconsidering the relevant test for legal reasons, we should consider your board's specific obligations.

So in my thinking about it, I've come up with 3

areas that I think we would all agree the Board has obligations. And I'm trying to connect those obligations to maybe what the appropriate tests should be.

First, the Board has an obligation to the Army Corps of Engineers to operate and maintain the project levees under the standards provided by the Corps. Part of that obligation includes an obligation on the part of the Board to ensure that changes to the project, whether they're encroachments or modifications, do not negatively impact the system.

In regard to this obligation, one could ask the question of what impact tests should be used. It seems that the logical answer is, for purposes of satisfying the Corps, the Board should use whatever impact test is used by the Corps. My understanding is that the Corps, in determining project impacts, considers whether the changes proposed will increase the stage at the design profile weaken the levee system or impede maintenance of the system.

And, again, I'm a lawyer not an engineer, so if I haven't correctly characterized the test, it should be whatever that test is that the Corps uses.

Therefore, to the extent that the Corps is driving the decision of which test the Board should use, I think the Corps has already answered the question.

Indeed, to the extent that the Corps was the designer of the system, the Corps should receive some deference in determining what test should apply.

So the second area in which the Board seems to have some obligations is as a responsible agency under CEQA. In the remaining cases, the Board may actually be the lead agency under CEQA. And in all of these cases, the Board is required to adopt a test of impacts that satisfies the Board's obligations under CEQA.

Countless CEQA documents have been certified in California, many by the Board, using the design profile test, the one that the Corps uses. The test appears to be tried and true. It does not appear that CEQA affirmatively requires consideration of any other test. And while the Board has, on occasion, varied from this test and elected to examine impacts on particular projects differently -- I think Tim Washburn's table speaks of that. He may speak to it further -- the Corps's test still rains a consistent and accepted standard. So that seems to be the second context of which you might need a test.

Finally, the third context, are actions of the Board that may result in damages by flooding because of levee failure will be tested by the legal doctrine of inverse condemnation. And this doctrine considers with

the State has acted in a way to take the property of an individual. State law most recently enunciated in Paterno considers whether the State action constituted a quote unquote "reasonable plan".

If the State was designing a new flood system from scratch, one could argue any of the tests in David's report would work to determine whether the Board acted reasonable. But here the system has already existed for many years. And as noted in the report and elsewhere, we're aware the system has defects and it's not operating as designed. We have erosion. We have through-seepage and underseepage, which all create risks that the system will not perform as designed.

As the agency responsible for the system, the State has an obligation to investigate and fix the problem. My concern simply stated, and this may be similar to what Ron Stork just noted, is that some of the tests, many of the tests contained in the report have the potential to lead to inaction or paralysis.

Some of the tests can be argued to chase academic impacts through the system to such an extent as to make the correction of the existing defects completely impracticable. And a failure to act because of that paralysis would almost certainly be deemed an unreasonable plan by the courts and thus would result in liability for

all the wrong reasons.

So, in short, I raise for this Board the very basic question of why we're engaging in the exercise or why you are, because you will make the ultimate decision? And whether selection of a new or different test is necessarily advantageous for the State, local agencies or millions of people who rely on the system. As my comments suggest, I have serious questions as to whether changing the test is really the best thing for the stakeholders.

I'll offer just one final comment and I thank you for your patience on my lengthy comments. I'm not an engineer, but I do want to highlight at least one specific concern about some of the tests in relationship to the baseline methodology. And there appears to be, in my mind, a fundamental inconsistency there.

In discussing the baseline, the report explains that the baseline assumes, and I'm on page 30, "All project levees in the Sacramento River upstream of a proposed improvement site are considered to pass safely the design event without overtopping or breaching." And we talked about that a little bit earlier.

In other words, we assume those upstream levees have adequate freeboard, no erosion problems and values for through-seepage and underseepage all within acceptable ranges. In this context, it seems odd to me that we would

assume all of that as a baseline and yet we might look at some of the impact tests which could make it all but impossible to actually reach that baseline for those upstream levees. Stated differently, we assume a perfect state for our upstream levees for purposes of determining impacts. But when it comes to those upstream levees, and proposing improvements for them, we consider various tests which might make it impossible for those levees to ever actually be perfect. And that just seems to me to be internally inconsistent.

So thank you for the chance to make the comments.

PRESIDENT CARTER: Thank you.

MR. WASHBURN: Tim Washburn, SAFCA. Since my table was mentioned --

(Laughter.)

MR. WASHBURN: Since we're on a roll here with attorneys.

(Laughter.)

MR. WASHBURN: There is a table in David's report in the appendix that SAFCA compiled and I'd like to explain it a little bit, and maybe answer a little bit Scott's question of why are we having this discussion and why do we have this report?

The fact of the matter is the Rec Board hasn't exactly been terribly consistent in applying the

methodology that Scott refers to here that I believe with Scott is the methodology that the Corps uses, that is to say, does your project raise the design water surface elevation at the design flow? Does it interfere with the operation of the flood control system? The typical kind of analysis, for example, when we want to do a restoration project or a river-front master plan or some other project where the first question is, are you adversely affecting the flow, the design flow? And it's very hard sometimes where we're talking about a restoration project or a river front mater plan to make that showing. But that has typically and historically been the test.

Now, the Corps does add a takings analysis. But the Corps' takings analysis I was introduced to when I first came to SAFCA and we sent our report back to Washington for the American River Watershed Investigation. And the Corps, because they actually hadn't done the inventory properly and hadn't really done the cost benefit test for protecting North Sacramento, had kind of said, well, we'll put that in as hydraulic mitigation. I mean we're raising the levees around Natomas. Surely, they recognized we ought to be raising the levees of Dry Creek and Arcade Creak. The report went back recommending the improvements on Dry Creek and Arcade Creek as hydraulic mitigation directly to communities, directly across the

Natomas East Main Drain.

And, of course, it came back from the Corps saying that's not our theory of hydraulic mitigation. There's no taking there. There's no evidence that your project is going to cause the frequent inundation of the area that you're taking about protecting. That doesn't meet our standard of taking. And they completely rejected it as a theory of hydraulic mitigation, and sent it back to SAFCA and said you guys are going to have to pay for the improvements on Dry Creek and Arcade Creek. There's no justification hydraulically for including those in the project.

So the Corps's test on hydraulic mitigation is extremely low. And we know this also from the West Sacramento project. The first one I put in my table. Yes, there was acknowledged we raise the levee around there and some gigantic flood on the Yolo Bypass, there would be a higher water surface downstream.

So from the Corps' point of view, did it affect the economic value of the property substantially? Did it affect the reasonable economic expectation to the owner of the property? The Corps' conclusion was no, it's a 400-year flood. There's a larger inundation after an area has already gone deeply under water. That's not mitigatable.

So the Corps's standard, which The Rec Board used in that project and has used several times, is essentially as Scott described it, did you raise the design water surface elevation? Did you interfere with the operation of the system? They don't pay a lot of attention to the idea that you may have increased water surfaces in rare floods in areas downstream or even in the case of Sacramento an urban area directly across the way. The Corps does not do that.

Now, The Rec Board has not always adhered to that Corps policy. So the second one I noted in our little table was Folsom Re-op, because we came around in 1993 to raise the levees around portions of the Natomas Basin. We didn't increase the design flow. We didn't interfere with the operation of the system. We merely reduced the risk of failure into that basin. But The Rec Board said well, what are you doing about, you know, the displaced water in the rare floods that you're protecting against?

We said, well, do we have to do something? They said yeah. We said, well, we have re-op. And they accepted that as mitigation. And people criticized me for having -- or SAFCA for having caved in to the requirement for such a thing, but, you know, opportunist as usual, we said okay, well, we have re-op. Okay, it's a kind of true exceedance, because we now added storage to the system to

offset whatever impacts may occur as a result of our levee raising and that was acceptable.

Okay. It's not an easy one, as David points out. It does work. You do have to forecast coordinated operations at Oroville. You have forecast -- there are ways to do the true exceedance thing. It's extremely difficult to measure that sort of analysis. But nevertheless, that was the rule imposed upon us by The Rec Board when we got our Natomas permit in 1994.

Okay. Then we had a series of cases a little different, and probably need noting, which are well, what about when your project impacts somebody who's not in the project? The Aikens case where the flood control project is backing up water on lands that actually aren't in the project and aren't protected by the project. And there at least in California the courts have been a little stricter saying sorry. That's almost a strict liability case.

And so we've had 3 of those, because we have Pleasant Grove up in Sutter county, that lived on the other side of the Sankey Gap, and who complained, if we close that Sankey Gap, you're just going to back more water up onto us and we're not in your project. So we did David's first mitigation one, we avoided it. We left the Sankey Gap open, which it is today. So we didn't close it, and we avoided a conflict there. But that one I

believe and the second 2 are of the same type. When you're impacting property that's not in the system, that's not protected by the project, you might have a slightly different rule.

The other 2 we had along that line were the famous Bell Aqua, Chris Quackenbush, case where as we protected Natomas and north Sacramento and chased the flow backup Dry Creek, we ran into a subdivision up there that complained, and said no, wait a minute, you're raising the water surface elevation here a couple of tenths in a 400-year flood. And we said yeah, well, a couple tenths in a 400-year flood, we'll buy insurance. That's the most economically viable remedy for that problem. It's cost effective. You're rarely going to see this type of flood.

And the Rec Board said no, that's not acceptable. That's not an acceptable mitigation measure. In effect, you have to provide equal protection to the Bell Aquans, which I'd characterize as levee parity. You have to build a levee around Bell Aqua that's equal to the levee that you're building around north Sacramento. So we did that. That was a Rec Board rule.

Then we have the good folks down in Point Pleasant in the Beach Stone Lake floodplain, who also are not in the project. They are suffering, from their view, from the impacts of the project upon them. And the rule

there was, we acknowledge in raising the Beach Stone Lake levee to keep the Cosumnes/Mokelumne River out of Sacramento, the city, you would raise the water surface elevations down there in very rare floods. In that case, The Rec Board was more amenable to the insurance mitigation, and we did that.

And I would say those cases where you're impacting folks outside the project, you may need a variety of tools to mitigate those impacts different from what you might say are the requirements for folks within the project itself or then I would get back more toward Scott's rule, and the rule that we used whether in the Sacramento urban project or in many of the early nineties' projects, West Sacramento, Yuba Basin, where the Rec Board was quite comfortable with the Corps role. And we didn't run into the problem that we've run into of late, which is some anxiety about continuing to use that methodology.

And, you know, I understand that. But in any case, I wanted to clarify the table that SAFCA had put in there. We do have a rich experience in dealing with these issues.

MR. COUNTRYMAN: Can I --

PRESIDENT CARTER: Joe, you had a couple opportunities. I have a couple of cards here.

Mr. Foley, did you want to address?

MR. FOLEY: I'll pass.

PRESIDENT CARTER: Okay. Mr. Buer.

MR. BUER: Yes.

PRESIDENT CARTER: Let's give Stein a chance, and then those who have already spoken can speak again.

MR. BUER: Good afternoon. I'm Stein Buer, executive Director of SAFCA. And I want to thank the Board for providing us with this opportunity at this time to confront this very difficult issue and to David Ford and his associates for putting together a very thoughtful analysis that really lays out for us the scope of the problem that we've been grappling with, as Tim just alluded to, over time.

The main thing I wanted to say, in addition to agreeing with most every comment I've heard so far, particularly Scott was very lucid in laying out the historic practice and the reason for doing so. I just want to emphasize how critically important it is for the Board to step forward into joint leadership in this situation. I think the Board is up to that task.

We have a historic convergence of events. And the stars are lined up right now to make decisive improvements in the system. Those stars do not stay lined up very long. We have a short moment in time, a few years, a handful of years. And I've seen, as I'm sure all

of us have seen, these opportunities come and go. We watched the Comp Study, a strong mandate after the '97 flood and was unable to bring the issues to conclusion in a way that allowed us to move forward and an opportunity was really lost.

The CALFED Bay/Delta Program is not quite gone, but we still have a very strong mandate after Governor Wilson's statement back in 1994. And they had about 6 to 8 years to play that out.

So we have that moment now. And the Board stands in the position to guide the solution that we're all struggling with. With Paterno in our rearview mirror proceeding fairly rapidly, with Katrina also now beginning to recede, we don't have much time left.

So being practical in how we move forward is of prime importance. And this was reflected by Ron Stork and I think also by Tom Eres and also by Scott. It's very important that the rule that you go by be understandable, be explicable, so that the voter who empowered the State with $4 billion to do something right with the money will understand what you're doing, and that it makes common sense. That it makes sense to the person on the street that's funding all our efforts here.

I think the proposed definition, number 1, from my perspective, fits that rule very well. Almost anyone

can understand we design to a certain condition. And as long as you don't impact that condition, you're not having an impact.

I think Dave did a very good job of articulating the challenges of defining impacts through these various other alternatives. The challenge can only be as good or greater than you've articulated. Having chased these kind impacts for years, I think it's excruciatingly difficult to define impacts through a very complex system that is changing every single year. With the addition of new projects, with climate change, with new understanding and new standards, it is an impossible task to fully model and understand the impacts of a single action on the system as a whole.

I would propose that the mitigation options that Mr. Ford has proposed not be seen as a necessary tool for mitigating impacts on the system, but as tools for enhancing its performance to reduce risk. For example, if we talk about counting on levee failures in a certain area, we should think about compensating those areas upfront, explicitly acknowledging here is an area where we would like to see potentially compensated for levee failures if we don't do anything else to improve the performance. But we don't count on them failing unless we have explicit tools in place for compensation, including

insurance and so on and so forth. So those are very valuable tools for enhancing system function.

And so I think I'll close by just saying we have an opportunity. We must have a clear well-defined plan and well-defined tools. I think the opportunity is here now, and I hope we can seize it.

Thank you.

PRESIDENT CARTER: Thank you.

Mr. Twitchell.

MR. TWITCHELL: Thank you. Jeff Twitchell with Wood/Rogers. I just want to echo some of the statements that have been shared with David and his statements. I think going forward with the modeling that's taken place and that continually takes place, it's tough as a consultant to get the latest greatest model that's, you know, effective for the area that you're working in. And I request, you know, some improvement in the process. We must have, I think, someone in the State, being the major record holder of the latest model or models, because it's just really difficult to make sure -- you know, making sure that you've got the correct model that should be utilized for each new project, particularly when you're dealing with setbacks or, you know, eco-restoration improvements.

I'm suggesting that just procedurally that when

someone submits an application that's changing or modifying the system, that they provide that model to the Board or the staff. And that when that permit is issued, say if there's an approval of that project, that that piece now become part of the model somehow, versus, you know, it remains in the consultant's hand who did that work. There's got to be an essential clearing house.

And, Dave, I think you suggest that to some degree. That needs to take place. So we just need to improve that. And I think particularly as there's larger and larger competition for this 1E and 84 money, you're going to see, you know, some of the consultants being responsive to their client's request in keeping some of that stuff closely held. And I think it needs to be more open than shared. You know, that's somewhat of a request.

The other thing, David, is I left the room earlier, so I don't know if you talked about a lot of our modeling is based on one dimensional modeling. But I think with some of the setbacks, I think we're looking at -- we're finding that 2-D is a better approach and, you know, provides further definition, because you don't have equal benefits on either side of the river on all these projects. So I don't know if you have anything to add to the discussion about 2-D modeling.

DR. FORD: Jeff, I don't think we really

addressed that particular point. But in the report we did make the point from time to time that some of the impacts are impacts just across the stream as opposed to downstream or upstream. And certainly with a one-dimensional model that's sort of the standard of practice, this HEC-RAZ program you won't see that. And so if we suspect that, then I think we have no choice, but the right scientific choice and that would be to use a two-dimensional model.

So I would agree with what you said there. I think that's a critical issue.

MR. TWITCHELL: Thank you.

PRESIDENT CARTER: We have time for one more question and we want to wrap it up.

Joe.

MR. COUNTRYMAN: I had a card in there.

PRESIDENT CARTER: I kind of bypassed you, I'm sorry, because you spoke a couple times before.

But please.

MR. COUNTRYMAN: Joe Countryman, MBK Engineers, also the engineer for the California Central Valley Flood Control Association.

My comments have been run by the association, but because of the shortness of time, they don't have the stamp of approval yet, but we do intend to have the

Association approve our position here.

It seems like what we have are 2 conditions when we talk about these permitting requirements. One is things that weaken the system or diminish the system, i.e., somebody builds something between the levees; somebody digs a hole next to the levee; somebody plants trees in the floodway. All of those things have the potential for lowering the level of protection. And I think probably any of the indices could address that. Indices one is certainly the simplest and is probably maybe the best.

Our concern, our association's concern, at least my concern, is the other group. And that group is where you're not diminishing the levee, but you're strengthening the levee. So by strengthening the levee, somehow that's causing you to do mitigation someplace. And we're very concerned that once you start down that road, would you be allowed to do a flood fight on a levee? After all, the levees is ready to fail. You're out there doing a flood fight. Would the Rec Board prohibit a flood fight?

In 1995 the Department of Water Resources did a flood fight on the top of Cache Creek levee when water was flowing over the top of it about 1 to 2 inches deep and saved that levee from failure. If it's the Board's policy no levees must fail in order to provide protection to

somebody else, I just wonder, you know, is that a board policy?

Secondly, if we strengthen a levee, so it doesn't fail and then you try to do the analysis of what the impact is, I give -- I have some handouts that I provided that you can look at later, but if we look at the most recent levee break experience that we had, in 1986 the levee break occurred a day after the peak occurred. So there would have been -- there was no relief for anybody as far as what the peak flow was, either upstream or downstream from that site.

In 1997, the break occurred on the Feather River right at the peak. And the models show that there was some reduction in peak downstream, I think, about a tenth of a foot near Verona, but no reduction upstream. And the Sutter Bypass failure in 1997 occurred after the peak and had no effect on the peak flows downstream.

So now you're trying to evaluate -- by making that levee stronger, have you adversely affected somebody else? Exactly how do you do that? It could be -- depending on when the break occurred, it could be nothing. It could be very small. And on the other hand if it broke say a half a day before the peak, it could be very significant. These are details that would have to go into the indices that David's talking about that we have not

put in in the studies that I've tried to do this type of analysis in the past. And how you make the assumption would drive the result.

And so I think we have to be really careful when we're saying we're going to have other people rely on your levee failure, how that's going to be evaluated and so forth. That's why we believe that analyzing the design flow, does your project affect the design flow and the design stage in the system is the most consistent, has the least assumptions associated with it and really is what our recommendation is right now.

PRESIDENT CARTER: Thank you.

Thank very much. At this point, I'd like to conclude the question and answers. I think Jay is going to help us wrap-up and talk about some next steps.

GENERAL MANAGER PUNIA: Where we are going next, I think as -- in the beginning, we mentioned that this is a technical report. We are now going to bring it back to the Board for an action item for approval from the Board. We heard your comments. We will ask Dr. David Ford to incorporate some of the comments to express -- to make some fine-tuning, if we can, to address your concerns, and then we are going to finalize this report.

And the way this report is going to be used, this is one of the tools to address this complex issue. So

this report will be used by The Rec Board staff, so that we can provide the best information to the Board so that they can make these decisions on future projects. Along with the policy decisions and the technical information, I hope -- the hope is that we can provide the information needed by the Board to make these difficult decisions.

Thank you.

PRESIDENT CARTER: So, again, I'd like to thank all of those who participated in not only the session today but the generating of the report. Dr. Ford, thank you very much for your efforts. I'm sure we'll continue to rely on your expertise, as well as the expertise of all of you. There were some very insightful and thought-provoking comments today. Lots for the Board to consider in moving forward. We do appreciate your participation and invite you to continue to stay engaged. We're not done with this right now, but there will be more to come.

So thanks very much and we're adjourned.

(Thereupon the Reclamation Board workshop adjourned at 4:25 p.m.)

CERTIFICATE OF REPORTER

I, JAMES F. PETERS, a Certified Shorthand Reporter of the State of California, and Registered Professional Reporter, do hereby certify:

That I am a disinterested person herein; that the foregoing Reclamation Board workshop was reported in shorthand by me, James F. Peters, a Certified Shorthand Reporter of the State of California, and thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop nor in any way interested in the outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 20th day of March, 2007.

JAMES F. PETERS, CSR, RPR
Certified Shorthand Reporter
License No. 10063